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CURRENT TASKS OF USSR MICROBIOLOGICAL SCIENTIFIC RESEARCH  
INSTITUTES IN CONNECTION WITH WORK ON BACTERIAL PREPARATIONS

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A. N. Meshalova

The Soviet scientists who constitute the personnel of the numerous microbiological institutes have made a large contribution to the theory and practice of microbiology and epidemiology. They have expanded our knowledge in the fields of etiology, epidemiology, diagnostics, and prophylaxis of infectious diseases. They have also carried out major investigations aiming at the development of new methods of immunoprophylaxis. This work resulted in the development of highly effective preparations to be used against bacterial and virus infections.

In recent years, new methods of diagnosis and prophylaxis of infectious diseases have been developed. A new technology for the production of bacterial preparations has been introduced into practice. Extensive work has been carried out on the perfection of preparations which are already available and on the development of new, more effective preparations.

For instance, new living vaccines against tularemia and brucellosis have been introduced into antiepidemic practice. A living anti-influenza vaccine, and antiencephalitis vaccine, and a vaccine effective against leptospirosis have been developed. In 1953, almost all institutes of vaccine and sera have converted to the production of smallpox and BCG vaccine in the dry state. This prolonged the period during which these preparations can be stored and made it possible to transport them over long distances. At present, the development of another dry preparation, i.e., tuberculin (Leningrad Institute of Vaccines and Sera), has been completed and a dry antirabies vaccine is being developed (Control Institute of Vaccines and Sera, the Odessa, Tbilissi, and Khar'kov Institutes of Vaccines and Sera, and the Smolensk Medical Institute). The Institute imeni Gamaleya has proposed a new dry preparation to be used in the prophylaxis of intestinal diseases, namely Immunogen, which is now being subjected to extensive epidemiological tests. Finally, the production of dry diagnostic sera and of other diagnostic preparations is being developed (Moscow Institute of Epidemiology, Microbiology, and Hygiene).

The method of cultivating various bacteria in depth [the submerged culture method], which has been developed at the Institute imeni Gamaleya, opens up unlimited possibilities as far as the production of vaccines is concerned. Work on the development of this method is being conducted at a number of institutes. At all institutes of vaccines and sera a new, more perfect method for the purification and concentration of therapeutic and prophylactic sera is now being applied. This method is Diaferm 3, which has been proposed by the Institute imeni Gamaleya. In connection with the development of this method, new equipment has been designed which corresponds to the present level of technological development.

It is not necessary to enumerate all achievements of the institutes. The brief account which has already been given testifies adequately to the fact that the microbiological institutes have achieved significant successes in their scientific work. However, they are faced with new tasks, the solution of which will ensure advances in the work on the elimination of the majority of infectious diseases. The principal task which has been set by the Ministry of Health USSR for all workers of the Sanitary-Antiepidemic Service is a sharp reduction of the incidence of infectious diseases.

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Within the total complex of antiepidemic measures an important role will be played by specific prophylaxis carried out by means of preventive inoculations. The primary and basic task to be accomplished by the institutes of vaccine and sera is to ensure an uninterrupted supply to the country of highly effective bacterial preparations.

It must be noted that not all preparations being released by the institutes are sufficiently effective and perfect.

First, it is necessary to point out the insufficient effectiveness of vaccines against intestinal diseases.

For this reason, one of the principal problems that is to be solved by microbiological institutes is the development of standardized and infallibly effective vaccines against intestinal infections, particularly dysentery. To solve this problem, the institutes of vaccines and sera must concentrate their attention on the questions discussed below.

The immunogenic properties of bacterial vaccines, including vaccines against intestinal infections, depend on the complete antigenic effectiveness of the cultures used for the preparation of these vaccines. Nevertheless, the investigation of the principal properties of bacterial cultures, i.e., of their virulence and their immunogenicity, has not yet been emphasized adequately in the plans made for scientific research work to be done at the institutes. The problem of the evaluation of the quality of strains by a test tube method has not yet been investigated. This refers to tests determining the content of specific antigen. Methods of preservation which would ensure the stability of the principal properties of the cultures have not yet been developed. The importance of the problems in question is quite obvious; this complex of problems has been repeatedly discussed at various meetings. However, work on this range of subjects is not being conducted at a single institute.

Furthermore, although the method of culturing in depth has been developed to the extent that it can be used on a practical scale, problems connected with its theoretical background are not being investigated adequately. Particularly unsatisfactory is the work pertaining to the standardization of vaccines. From this point of view, the possibility of applying synthetic media in the production of vaccines against intestinal infections which will make it possible to maintain standardized conditions of cultivation is of particular interest. Although synthetic media are being investigated at present at the Institute imeni Gamaleya, work in this field must be expedited.

One of the conditions which will ensure further improvement of the quality of vaccines will be the availability of a reliable laboratory method of evaluation based on a determination of their immunogenicity. At the present stage, this important problem remains unsolved. To achieve a correct solution of the problem, it is necessary to carry out many-sided investigations on the subject with a number of vaccines and sera institutes participating. The initiative in organizing this work must be taken by the Division of the Institutes of Vaccines and Sera. Both central and peripheral institutes should be induced to participate in this work.

To ensure that the antiepidemic service is supplied with infallibly effective vaccines against intestinal infections, the institutes finally must include in their plans checking of the preparations under actual epidemiological conditions. It is hardly the correct procedure to apply the preparations without sufficient checking or delay their application on a large scale because no checking has been done. For instance, the Institute imeni Gamaleya has developed a new preparation for the prophylaxis of intestinal infections, i.e., the so-called immunogen. However, immunogen cannot yet be applied in practical

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work, because it has not been tested under epidemiological conditions. The search for effective preparations for the prophylaxis and diagnosis of children's infections, i.e., scarlet fever, whooping cough, and measles, proceeds unsatisfactorily. An undoubted achievement is development of the production of gamma globulin for the prophylaxis of measles. Recently the Moscow Institute of Epidemiology and Microbiology has developed a method of preparing gamma globulin from a new type of crude material. However, elimination of measles will be possible only by applying a preparation which produces active immunization. It must be noted that research aiming at the development of such preparations is hardly being done at all by microbiological scientific research institutes. It is essential that the institutes include work on this problem in their activity. We assume that the Institute of Virology of the Academy of Medical Sciences USSR should also devote more attention to the problem of measles.

A very important and urgent task in the field of research on effective preparations for the prophylaxis of children's infectious diseases is the development of purified deposited anatoxins.

In the resolution of an intrainstitute scientific conference which was held in April and which was devoted to the scientific basis of the production of bacterial preparation, the theoretical importance and great practical value of purified and adsorbed preparations has been mentioned. The conference noted the promising nature of the work being carried out by the Leningrad Institute of Vaccines and Sera on a highly purified diphtheria anatoxin adsorbed on aluminum phosphate. However, although the work that has already been done on adsorbed preparations represents an undoubted achievement, this work has not been conducted intensively enough. The institutes must secure the most rapid introduction into practical work of improved antigens, particularly purified diphtheria anatoxins.

Furthermore, notwithstanding many attempts which have been made in that field, the problem of combined preparations for the prophylaxis of children's infections still remains unsolved. The successive application of individual preparations presents considerable difficulties. The great number of inoculations which have to be carried out, the coincidence of individual inoculations, and the occurrence of contact infections acquired in the process of immunization create great difficulties in the organization of work on the prophylaxis of children's diseases. One can understand, under the circumstances, that the problem of combined immunization against several diseases is of great importance. Particular attention should be paid to work on combined preparations effective against measles, whooping cough, and tetanus; preparations effective against whooping cough and diphtheria; and preparations effective against diphtheria and tetanus.

The absence of effective and conveniently applied preparations for the prophylaxis of children's infections interferes with the elimination of the diseases in question. The incidence of these diseases is still rather high in the USSR.

As far as therapeutic and prophylactic sera are concerned, one must state that almost all institutes which produce preparations of this kind conduct work on their improvement. Convincing data have been obtained which indicate that it is possible to improve the effectiveness of sera by improving the conditions under which the horses that produce the sera are exploited. Investigations which have been conducted show that the age and the breed of the horses, the diet of the animals, the conditions under which they are kept, and more rational systems of immunization are of importance for the improvement of sera. However, the basic percepts of Pavlovian physiology are not being applied to an adequate extent in work on problems of immunogenesis as applied to serum production.

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In addition to the conditions of exploitation, the quality of the antigen used for immunization is of great importance. Not all strains which are at the disposal of the production establishments and from which antigens for the immunization of horses are obtained yield antigens that are highly active. One example is the diphtheria strain PW8, which has been cultured under laboratory conditions for decades. One of the principal tasks faced by the institutes of vaccines and sera is the search for new toxicogenic strains that will yield antigens having a high immunizing activity.

It has been said above that undoubted progress has been made in the production of therapeutic and prophylactic sera as far as purification and concentration are concerned. A new technology of production has been introduced and is being constantly improved and perfected. The new methods of purification and concentration (Diaform 3) which are being applied ensure the production of improved therapeutic and prophylactic sera. However, there is a lag as regards practical application of the results of scientific investigations conducted in this field. For instance, at the Leningrad Institute of Vaccine and Sera a new method for the purification of sera has been developed. The preparation which has been developed [with the aid of this method?] remains an experimental one which has not gone beyond the laboratory.

The problem of producing dry bacterial preparations deserves some attention. The production of vaccines and sera in the dry state has great advantages. Dry preparations preserve their activity and physical properties for a long time; they are convenient to use and can be transported at any time of the year, which is of considerable importance in view of the large territories that have to be supplied in the USSR [sic]. The availability of dry preparations will enable public health organs to have an assured supply of preparations for the prophylaxis of smallpox, tuberculosis, rabies, and other infectious diseases.

It has been stated above that the institutes have fully developed and introduced into practice the production of dry smallpox vaccine and of dry BCG vaccine. However, as far as the quality of these preparations is concerned, further work on their improvement is needed; it is necessary to achieve a maximum rate of survival of the living causative factor contained in the vaccines. Work on the development of a dry antirabies vaccine has been conducted at a number of institutes during the past few years. It has been established definitely that this vaccine can be produced, so the problem may be regarded as solved in this respect. It is desirable that the institutes and the Ministry of Health USSR expedite many-sided testing of this vaccine and its introduction into practice.

It is hardly necessary to mention that the production of dry diagnostic preparations, i.e., sera and diagnostics, is important. It is regrettable that work on this problem is not being conducted at microbiological institutes intensively enough. Only at the Moscow Institute of Epidemiology, Microbiology, and Hygiene is sufficient attention being paid to this problem. As a result, dry diagnostics and diagnostic sera have been obtained there. However, in this case the job has not been completed; the institute does not take any measures to expedite the application of these preparations in practical medicine.

In further reference to dry therapeutic and prophylactic sera, the institute imeni Gamaleya has begun investigations on their production. It is known that sera are used in very large doses. This circumstance is the chief difficulty connected with the solution of the problem in question, because special equipment for the drying of large volumes of liquid has to be developed. However, production of dry sera is of great importance, because it will make possible the storage of huge quantities of sera during prolonged periods. For that reason, the institutes must persistently continue work on the solution of the problem, with the aid of technicians who are specialists in this field.

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In connection with the production of dry bacterial preparations, one must not forget the strains from which these preparations are made. These strains must possess a number of definite properties: stability in the dry state, resistance to heat, resistance to light, etc. The application of strains which have these properties will make it possible to obtain preparations that can be stored not only at low temperatures but also at room temperature.

Of great importance are preparations for the prophylaxis of virus infections, which comprise a considerable proportion of the total incidence of infectious diseases. However, problems of the prophylaxis of virus diseases are being investigated by only a small number of institutes of vaccines and sera. The reason for this is lack of adequately trained virologists and of special equipment. To ensure the necessary scope of research in the field of virus preparations, institutes in the process of revision of their structure must provide for the organization of virus and rickettsia laboratories which will develop to a sufficient extent research and production work in the field of virus preparations.

Everything that has been said above indicates that microbiological scientific research institutes must carry out urgent tasks on the improvement of existing bacterial preparations and the development of new, more perfect bacterial preparations. The availability of these preparations to public health organs will make possible a successful solution of the basic problem with which the sanitary-antiepide-miological service must cope, i.e., achievement of a sharp reduction of the incidence of infectious diseases, and following this, total elimination of a number of infectious diseases.

To accomplish the basic tasks pertaining to the perfection and rapid introduction into practice of highly effective bacterial preparations, the institutes must be provided with improved and modern equipment.

As far as technical equipment is concerned, the microbiological institutes are lagging behind other branches of production. The institutes themselves and the Ministry of Health USSR must make efforts to eliminate this shortcoming. Investigations on a more extensive scale must be conducted, with the participation of engineers, technologists, biochemists, and other specialists whose collaboration may accelerate the investigation and adaptation of new technological methods and aid in the introduction into production work and production operations of exact recording appliances and of automatic control methods.

The tasks which have to be carried out at present by microbiological institutes are not limited to supplying public health organs with prophylactic and therapeutic preparations. One of the most important principles of Soviet medicine is prophylaxis in the broad sense of the word. The prophylaxis of infectious diseases is composed of general sanitary measures, antiepidemic measures, and therapeutic measures. The institutes of vaccines and sera and the institutes of epidemiology, microbiology, and hygiene are called upon to solve problems which pertain not only to the production of effective prophylactic preparations, but also to the organization of antiepidemic measures, of immunoprophylaxis, and of the diagnosis of infectious diseases.

These institutes must play a leading role in work which involves scientific evaluation of the epidemic status of the country and the organization of antiepidemic measures.

It is completely wrong for the institutes of vaccines and sera to undertake the work of sanitary-bacteriological laboratories by carrying out current analyses, or to attempt to do the work of sanitary-epidemiological stations by collecting and collating statistical data. On the other hand, it is the duty of the institutes to extend methodological aid in connection with the organization and application of antiepidemic measures and to instruct practical workers in drawing scientifically justified conclusions from the results of the measures applied by them.

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To conduct this work, the institutes of vaccines and sera must raise the level of their epidemiological divisions, the state of which at present does not always correspond to the tasks imposed on them.

Furthermore, the sanitary-epidemiological stations must organize the work of sanitary-epidemiological councils, where all antiepidemic measures will be discussed. The councils attached to the sanitary-epidemiological stations will be coordinating organs which will direct all antiepidemic work.

The exchange of experience with therapeutic-prophylactic organizations and recruitment of wide public aid will assist in achieving more rapidly a reduction of the incidence of infectious diseases in the country followed by complete elimination of such diseases.

The realization of the principal tasks to be carried out by microbiological institutes in the field of scientific research, as well as in organizational and methodological activities, is possible only if all members of the scientific staff of the institutes participate on the widest possible scale. One cannot permit the existence of a situation wherein individual members of the staff of an institute, who have scientific degrees of a candidate or even of a doctor of sciences, are incompetent in the solution of the most elementary problems of antiepidemic practical work because of faulty organization of their work at the institute. Such persons describe themselves by saying that they can do experimental work in the laboratory only, that they are "born for science." These people must be reminded that science can be properly called science only when it is connected with practical activities and is enriched by experience.

The absence of a creative link between science and practice often leads to fruitless searches and interferes with the solution of the most important problems of practical medicine. Nothing but the absence of a link between clinical work and bacteriological practice explains the futile scientific research on the modification of microorganisms which has been conducted for many years.

In addition to utilizing properly the scientific personnel which is available, the institutes must make efforts to train new personnel. All institutes of vaccines and sera and also the institutes of epidemiology, microbiology, and hygiene are in great need of highly qualified personnel. It is obvious that the task of training this personnel can be accomplished successfully only if the planning of training activities, the carrying out of these activities, and the control over them are regulated properly. Hitherto, proper regulation of these activities was lacking. The principal cause of this shortcoming was insufficient attention on the part of the heads of the institutes to the training of scientific personnel. At some institutes the old tradition still exists which regards scientific workers in production divisions as purely practical workers who should not participate in scientific activities and should not work on dissertations.

The supervision over scientific work, including work on dissertations, is unsatisfactory. The scientific councils of some institutes do not consider reports on these activities.

To ensure adequate solution of the principal problems with which the scientific research institutes of epidemiology, microbiology, and hygiene have to cope at present, it is necessary to organize correctly the research work carried out at these institutes and to distribute the scientific and technical personnel in an appropriate manner. The scientific councils must play a decisive role in the organization of scientific research and in the planning of the scientific work that is to be carried out. The members of the scientific councils must render active aid to the executives in organizing the work of the institutes.

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To advance science successfully, it is necessary to foster criticism and self-criticism because "science cannot develop and succeed without the conflict of opinions and freedom of criticism" (I. V. Stalin).

We have discussed only the most important tasks that have to be accomplished by the institutes of vaccines and sera and the institutes of epidemiology, microbiology, and hygiene. These tasks can be accomplished only if practical workers participate on a wide scale in the work of the institutes and if there is collaboration among workers at sanitary-epidemiological stations, bacteriological laboratories, and clinics of infectious diseases. Critical evaluation of the scientific activity of the institutes in the course of discussions at scientific conferences and at meetings of the scientific councils, accompanied by utilization of the creative initiative of scientific workers, will ensure success in the solution of the most important problem of a sharp reduction of the incidence of infectious diseases that has to be solved by the institutes.

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